PATENT SPECIFICATION 1,198,713

DRAWINGS ATTACHED.

1,198,713

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COMPLETE SPECIFICATION.

Improvements in or relating to Vehicle Wheel Suspension Assemblies.

We, BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT, of Lerchenauerstrasse 76, Munich 13, Germany, a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a suspension assembly for an independently suspended wheel of a motor vehicle, said assembly including a telescopic hydraulic shock absorber forming a rectilinear guide and a coil spring arranged coaxially of the latter, the shock absorber being articulated at its upper end to the vehicle frame and having a wheel support rigidly fixed thereto towards its lower end.

Such suspension assemblies have the disadvantage that binding and frictional forces in the shock absorber prevent the response of the latter to small road shocks. These binding and frictional forces are produced by a bending moment being exerted on the shock absorber, due to the wheel load, the said moment causing a bending of the shock absorber piston rod and thus resulting in an increase of the bearing friction in the shock absorber. Since the binding and frictional forces which are set up are usually greater than the forces caused by the small road shocks, the shock absorber is unable to absorb these shocks. This condition results in the road shocks being transmitted without springing and undamped to the vehicle frame and thus the running behaviour and the travel comfort are impaired.

In order to avoid these disadvantages, it has already been proposed in connection with a suspension assembly for independently suspended, steered front wheels of motor vehicles (our prior patent No. 1,102,492) for the axis of the helical spring to be offset in relation to the axis of the shock absorber which acts as a rectilinear guide. Due to this arrangement of the helical spring relatively to the axis of the shock absorber, a bending moment is exerted on the latter which, in the normal position of the vehicle, is of about the same value and opposite in sense to the bending moment exerted by the wheel load on the shock absorber, so that there is no binding between the two telescopic parts of the shock absorber even with small road shocks and thus the response of the shock absorber to small road shocks which is important for the travel comfort and running behaviour is improved.

The invention has for its object to provide a suspension assembly of the type indicated above, which also relieves the bending moment applied by the wheel load and to achieve this object with a minimum of expense in design and construction.

According to the present invention there is provided a method of mounting the helical spring of a telescopic strut type wheel suspension assembly which consists in stressing said spring asymmetrically of its axis so as to apply to said strut a bending moment in opposition to the bending moment applied by said wheel.

According to a further aspect of the invention there is provided a suspension assembly for an independently sprung wheel of a motor vehicle including a telescopic hydraulic shock absorber forming a guide and having a wheel support secured thereto which imparts a bending moment to said shock absorber and a coil spring associated with said shock absorber wherein said coil spring when installed in the suspension assembly is stressed, asymmetrically of its

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axis so as to impart to said shock absorber a bending moment in opposition to that imparted by said wheel support.

The expression "stressing said spring asymmetrically of its axis" shall be deemed to exclude stressing by lateral displacement of the turns of the spring out of the unstressed position thereof which forms the subject of our Patent Specification No. 1,192,766.

The invention will now be more particularly described with reference to the drawing, wherein:—

Fig. 1 is a diagrammatic view of one form of suspension assembly according to the present invention;

Fig. 2 shows the coil spring of the suspension assembly on Fig. 1 in the untensioned state;

Fig. 3 shows a modified form of the coil spring shown in Fig. 2; and

Fig. 4 is a diagrammatic view of a further form of suspension assembly according to the present invention.

The suspension assembly shown in Fig. 1 in respect of independently suspended wheels of motor vehicles consists of a telscopic hydraulic shock absorber 1 and a helical spring 2 coaxially surrounding the upper end of the latter, the shock absorber 1 being resiliently attached at its upper end to the vehicle frame 3 and rigidly fixed at its lower end to a wheel support 4. The wheel support 4 is in its turn pivotally attached (not shown in the drawing) by means of a transverse arm 5 to the vehicle frame. The spring 2 is mounted between parallel plates 10 which are attached to outer and inner members 8 and 9 of the shock absorber 1.

Referring now to Fig. 2, the helical spring 2 is coiled along a substantially straight line. In order to produce a greater bias or pretension on that half of the helical spring which faces the outside of the vehicle, the two end turns of the spring when seen in cross-section, are bent over by an angle α° towards one another, so that the bevelled support surfaces 6 of the helical spring 2 likewise extend obliquely towards one another. The planes 7 which pass through the support surfaces 6 of the untensioned helical spring 2 converge towards the inside of the vehicle, seen transversely of the latter, while the spring plates 10 connected to the shock absorber housing 8 and to the shock absorber guide rod 9, respectively, are arranged parallel to one another (Fig. 1). It is, of course, also possible to bend over one or more turns at one end of the spring only, so that only one of the planes 7 extends at an angle to the longitudinal axis of the spring.

As a result, when the helical spring 2 is installed, a greater bias is produced on that half of the helical spring 2 which faces the outside of the vehicle than on the half facing the inside of the vehicle, so that a bending moment is exerted through the plates 10 on the guide means, and this moment, in the normal position of the vehicle, is approximately equal and opposite to the bending moment exerted by the wheel load on the shock absorber.

Fig. 3 shows a helical spring 2^1 which is coiled about an arcuate axis the spring being untensioned. The two support surfaces 6^1 on the spring 2^1 extend obliquely at an angle to one another. When the helical spring 2^1 is fitted between the parallel plates 10 and when seen transversely of the vehicle, the longer surface line 11 of the untensioned helical spring 2^1 faces the outside of the vehicle, while the shorter surface line 12 of the helical spring 2^1 faces the inside of the vehicle, so that in the fitted condition, once again the outer half of the helical spring 2^1 is compressed to a greater extent than the half which faces the inside of the vehicle.

Referring to Fig. 4, two plates 13 are provided one being connected to the outer member 8 of the shock absorber and the other to the inner member 9, respectively, and when seen transversely of the vehicle, are arranged to extend obliquely at an angle to one another, the point of intersection of the two planes 14 containing the plates 13 lying on the outside of the vehicle. On mounting a straight-coiled, cylindrical helical spring 2^{11} having parallel ends between the plates 13, that half of the helical spring 2^{11} which faces the outside of the vehicle is compressed to a greater extent than the half facing the inside of the vehicle, due to the arrangement of the spring plates 13.

The above described embodiments provide a simple design, in that without alterations to the wheel suspension or shock absorber the latter is relieved of bending moments which are caused by the wheel load and prevent the ready response of the shock absorber to small road shocks.

Furthermore, the smaller space required for the fitting of the telescopic shock absorber with its surrounding helical spring according to the invention is of greater importance, since by the coaxial arrangement of the helical spring relatively to the shock absorber, no more fitting space is required than is the case with the conventional shock absorber and spring arrangements which do not provide for balancing of bending moments.

WHAT WE CLAIM IS:—

1. The method of mounting the helical spring of a telescopic strut type wheel suspension assembly which consists in stressing said spring asymmetrically of its axis so as to apply to said strut a bending moment in opposition to the bending moment applied by said wheel.

2. The method of counterbalancing the bending moment applied to a telescopic strut

by the wheel of a strut type wheel suspension having a helical load bearing spring which consists in stressing said spring asymmetrically of its axis so as to apply to said strut an opposing bending moment.

3. The method according to claim 1 or 2 which consists in angularly displacing the axis of at least one of the turns of the coil relative to the axis of the other turns and mounting said spring to reduce said angular displacement.

4. The method according to claim 1 or 2 which consists in winding said helical spring with an arcuate axis and mounting said spring to reduce the curvature of said arc.

5. A suspension assembly for an independently sprung wheel of a motor vehicle including a telescopic hydraulic shock absorber forming a guide and having a wheel support secured thereto which imparts a bending moment to said shock absorber and a coil spring associated with said shock absorber wherein said coil spring when installed in the suspension assembly is stressed, asymmetrically of its axis so as to impart to said shock absorber a bending moment in opposition to that imparted by said wheel support.

6. A suspension system according to claim 5 wherein in the unstressed condition the centre turns are arranged around a straight axis and the end turn at one end is arranged around an axis inclined relatively to said straight axis.

7. A suspension system according to either of the preceding claims 5 or 6 wherein said spring is wound symmetrically about an arcuate axis.

8. A suspension system according to claim 5 or claim 6 wherein the axis of at least one of the turns of the coil on at least one end of the spring is inclined with respect to the axis of the remaining coils thereof.

9. An assembly according to claim 8 wherein the spring is mounted between parallel plates which are attached one to each of the telescopic members of said shock absorber.

10. An assembly according to claim 5 wherein the spring is maintained between plates which are attached one to each of the telescoping members of said shock absorber and are inclined at an angle to each other, the point of intersection of the planes in which said plates lie being situated on the outside of the vehicle.

11. An assembly constructed and arranged substantially as described with reference to and as shown in Fig. 1 or 2 or 3 or 4 of the accompanying drawings.

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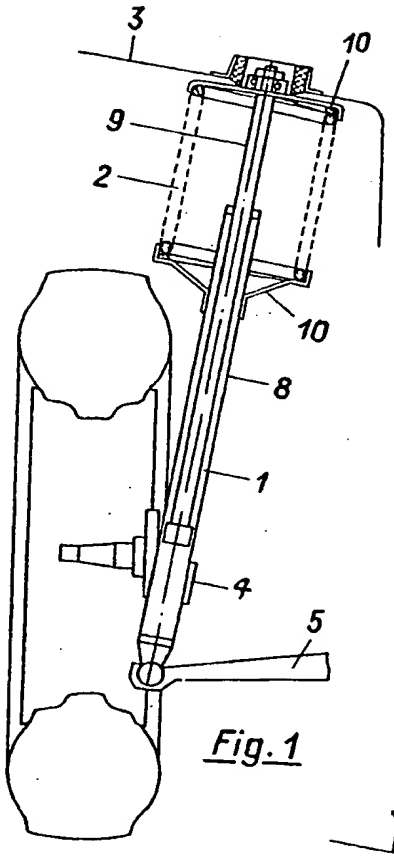

Fig. 1

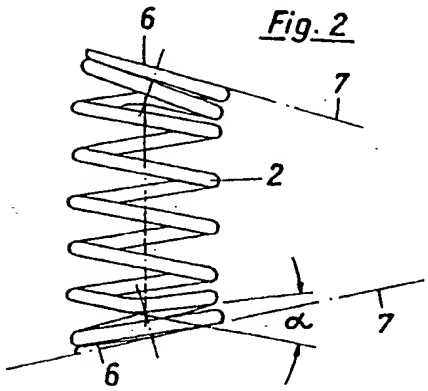

Fig. 2

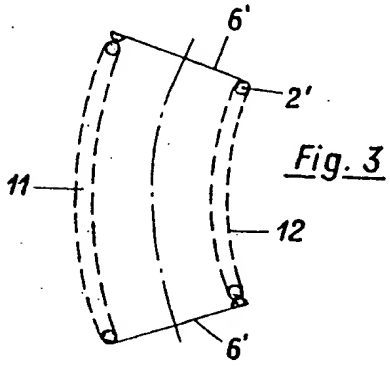

Fig. 3

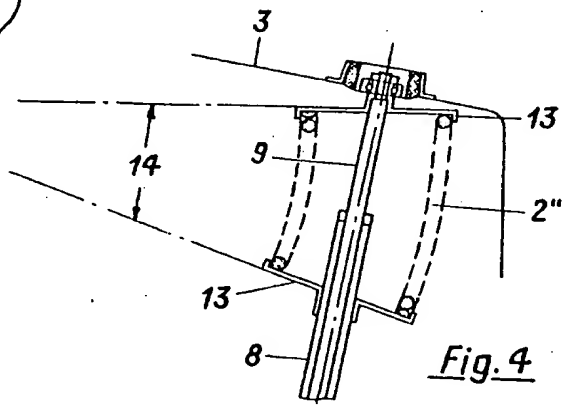

Fig. 4